Sea Ice Results from CESM Simulations

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CESM Atmospheric Components

Community Atmosphere Model version (CAM5.1):

- New RRTM radiation, MG microphysics, Aerosols, UW PBL, TMS
- New tuning and bug fixes
- 300-year control and three 20th century ensemble members
- RCPs are underway

Whole Atmosphere Community Climate Model (WACCM4):

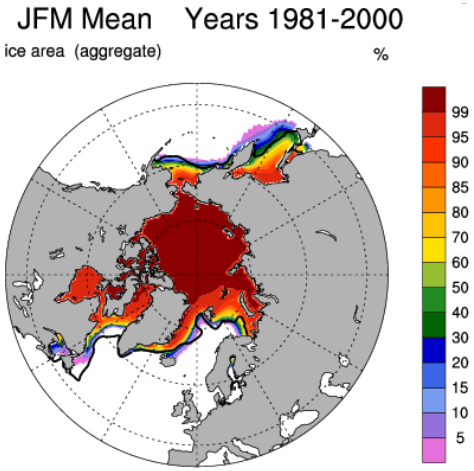
- High top at approximately 150km (CAM is at 40km).
- CAM4 physics + TMS
- 200-year control and three 20th century ensemble members
- Three RCPs (2.6, 4.5, 8.0) complete

Turbulent Mountain Stress (TMS)

- Gravity wave drag redistributes momentum, due to unresolved to gravity waves, from the mid-troposphere.
- TMS is an additional form drag that redistributes momentum from the surface sub-gridscale topography.
- Both physically realistic and complementary.

Arctic Sea Ice Concentration (JFM)

CESM-CAM5.1 E1



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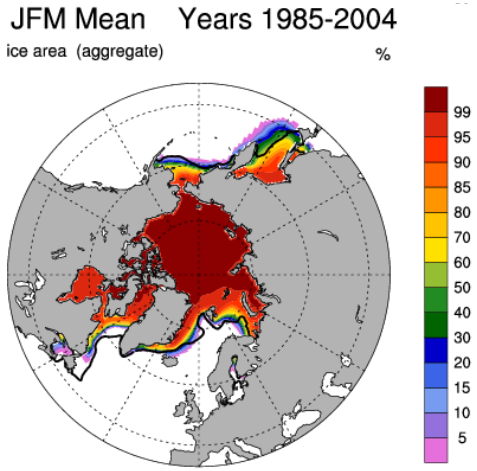
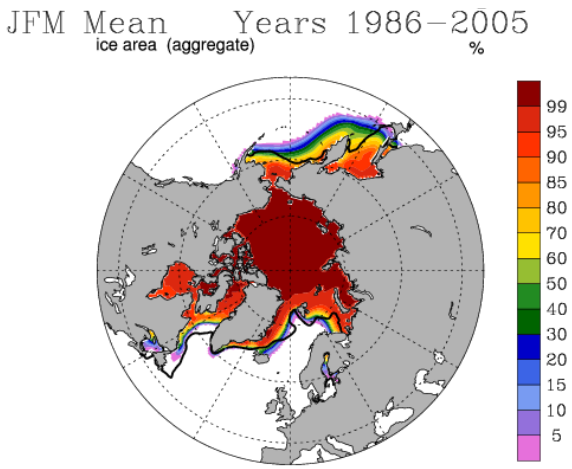
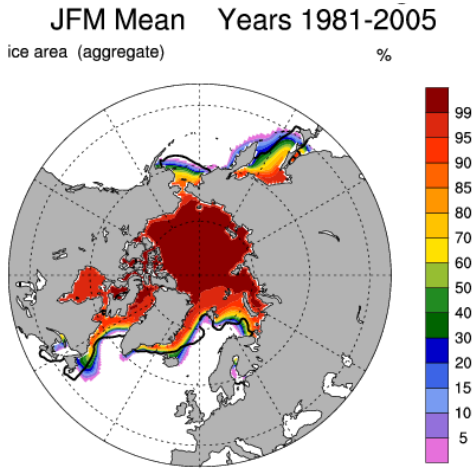


CESM-WACCM4 E1



CCSM4 E1



Arctic Sea Ice Thickness (JFM)

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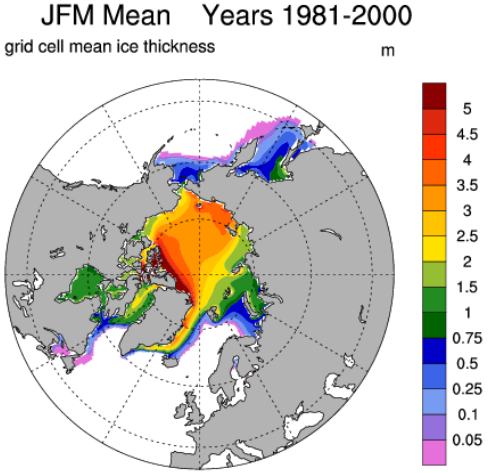

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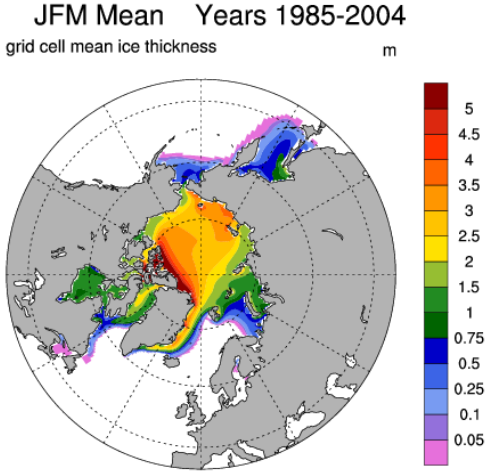

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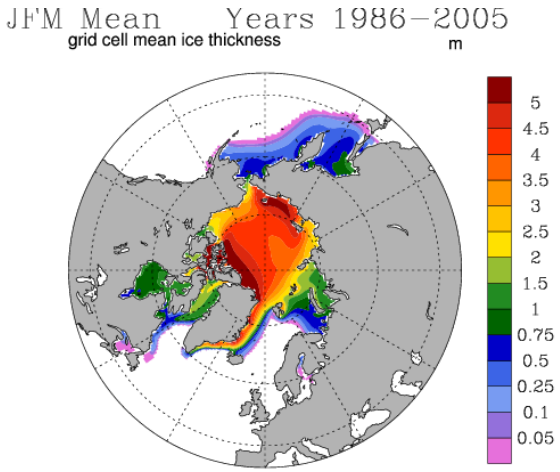

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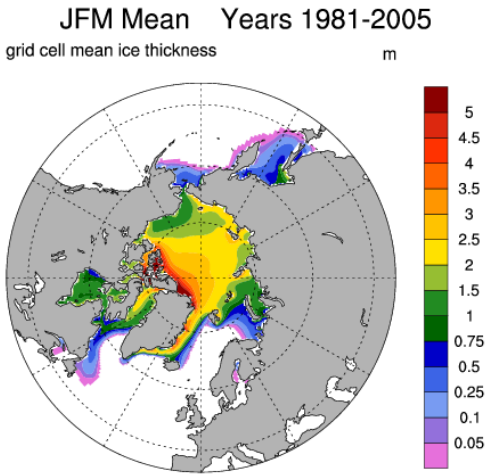
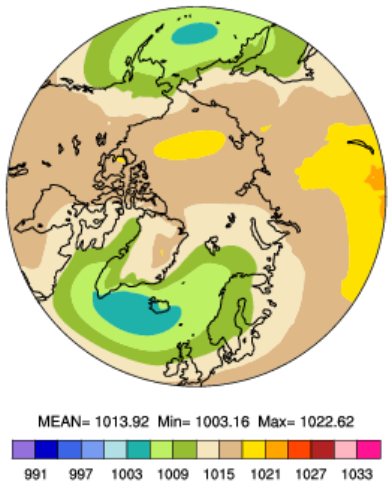
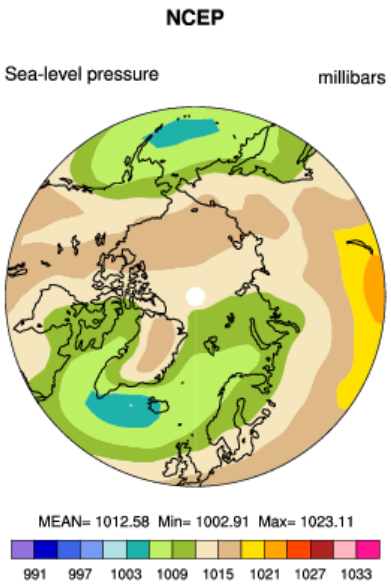
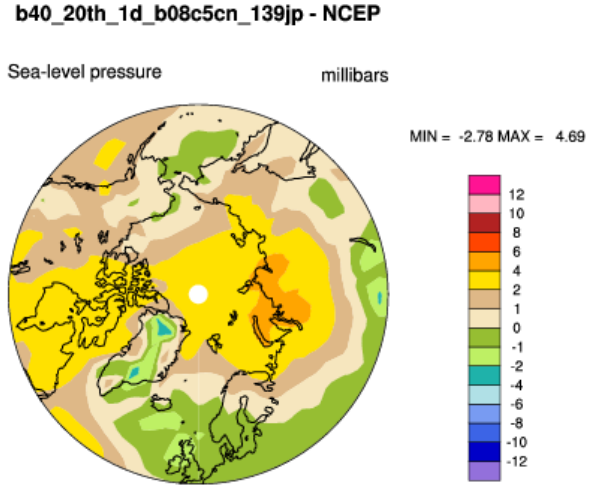


Arctic Sea Level Pressure (ANN)

CESM-CAM5.1 E2







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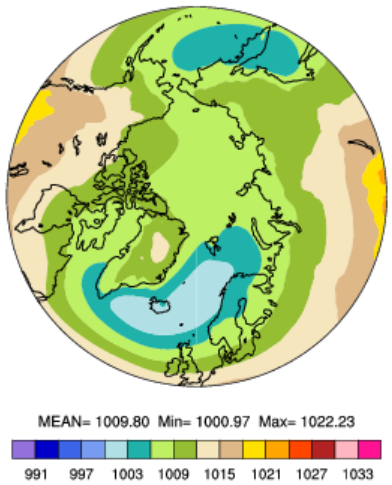
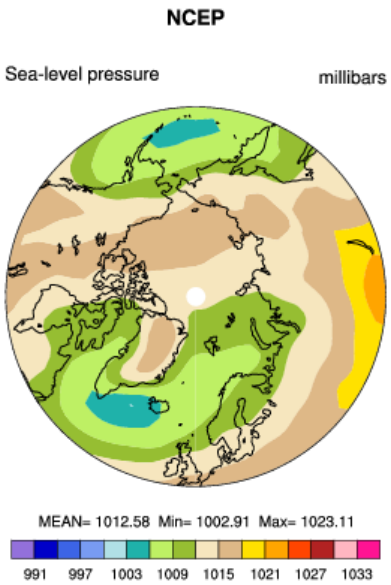
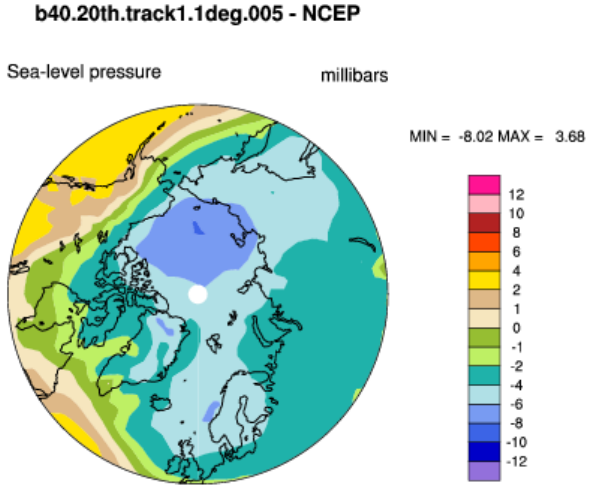
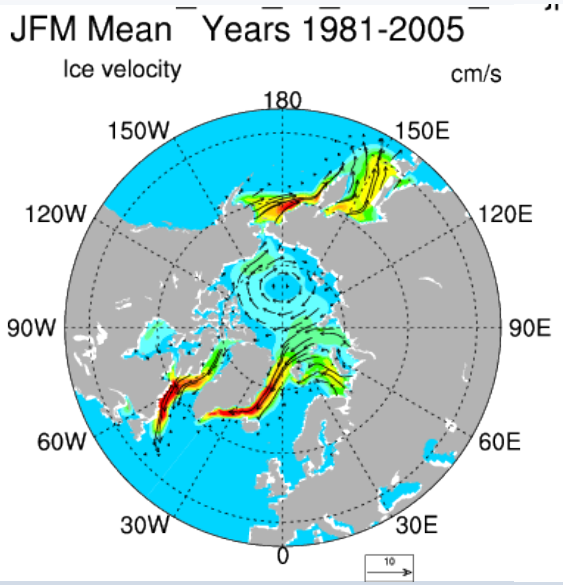






Arctic Sea Ice Velocities (JFM)

CESM-CAM5.1 E2



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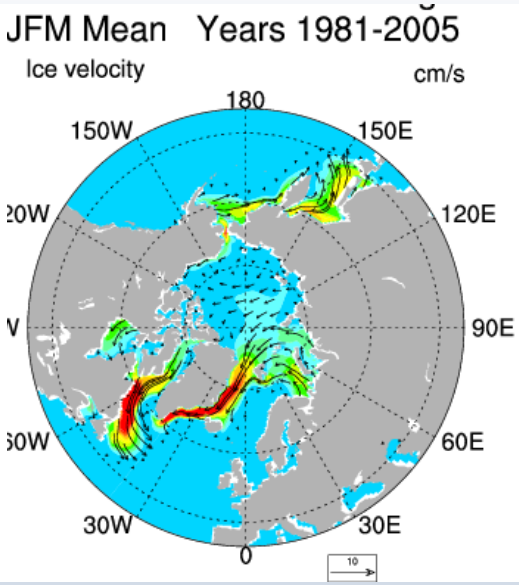
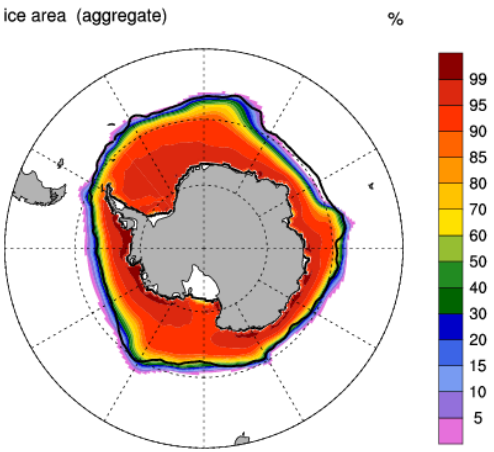


Antarctic Sea Ice Concentration (JAS)

CESM-CAM5.1 E1



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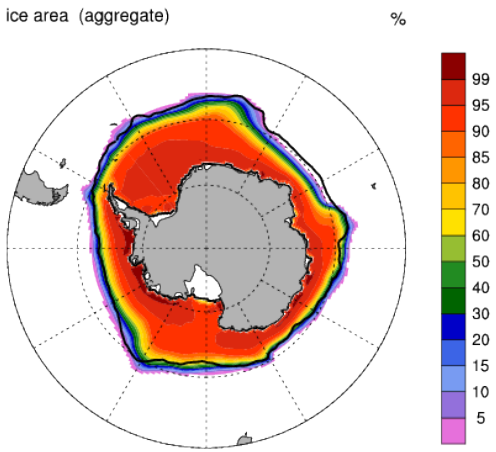
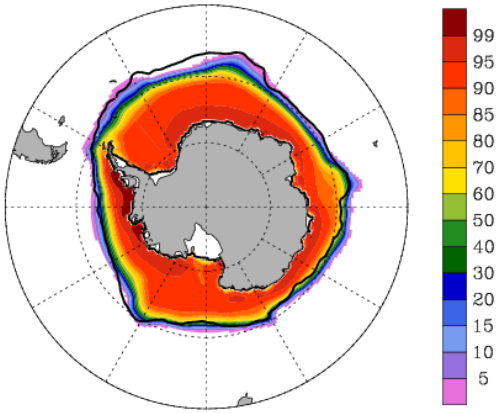


CESM-WACCM4 E1



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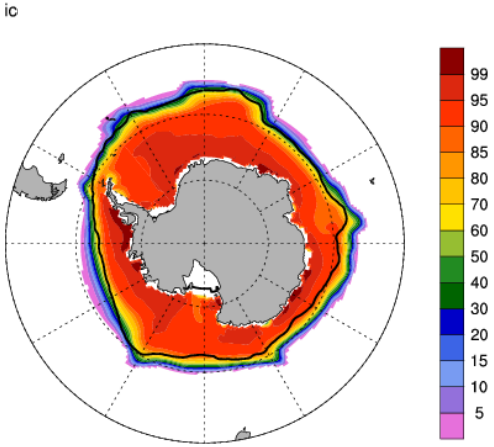
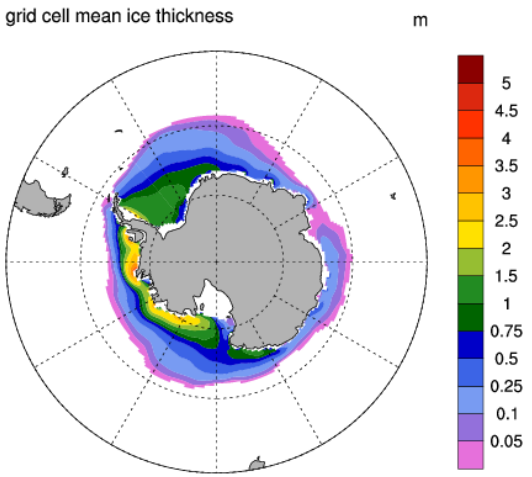


Antarctic Sea Ice Thickness (JFM)

CESM-CAM5.1 E1



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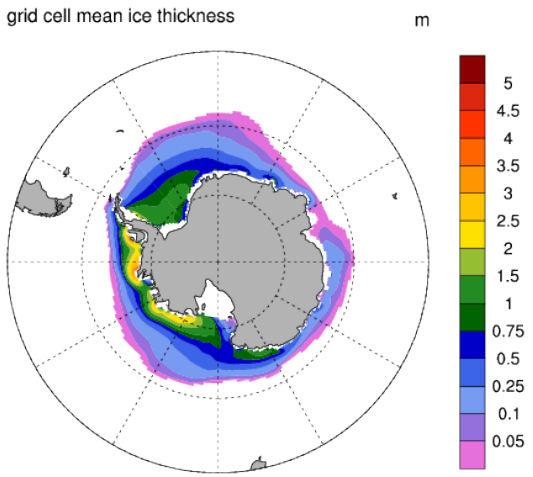

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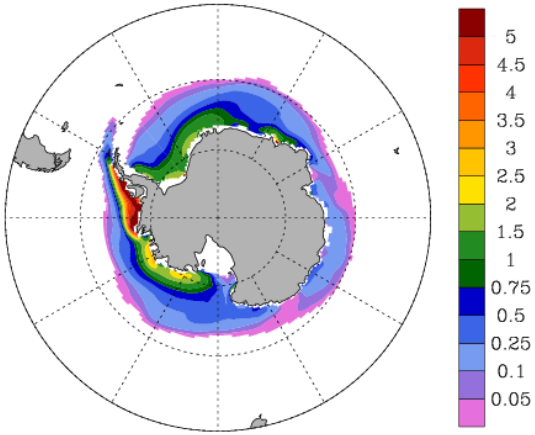

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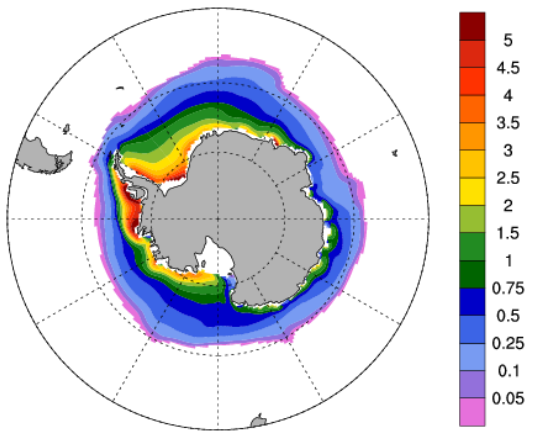
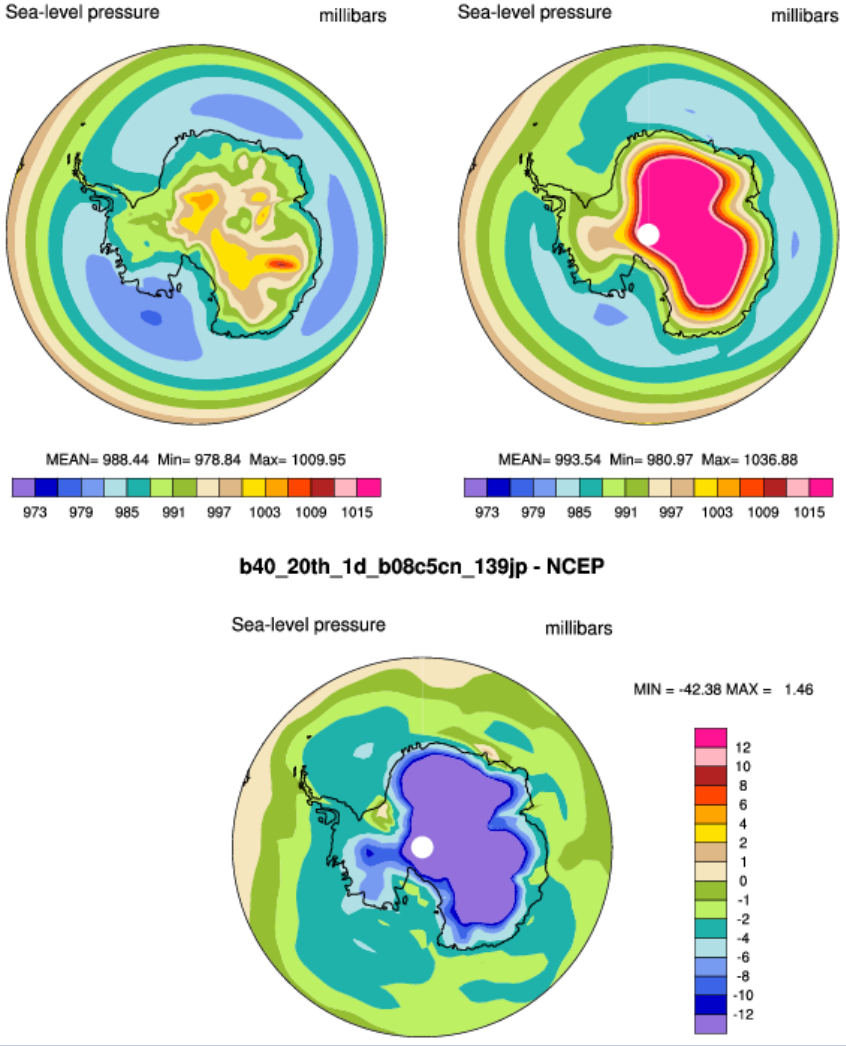


Antarctic Sea Level Pressure (ANN)

CESM-CAM5.1 E2



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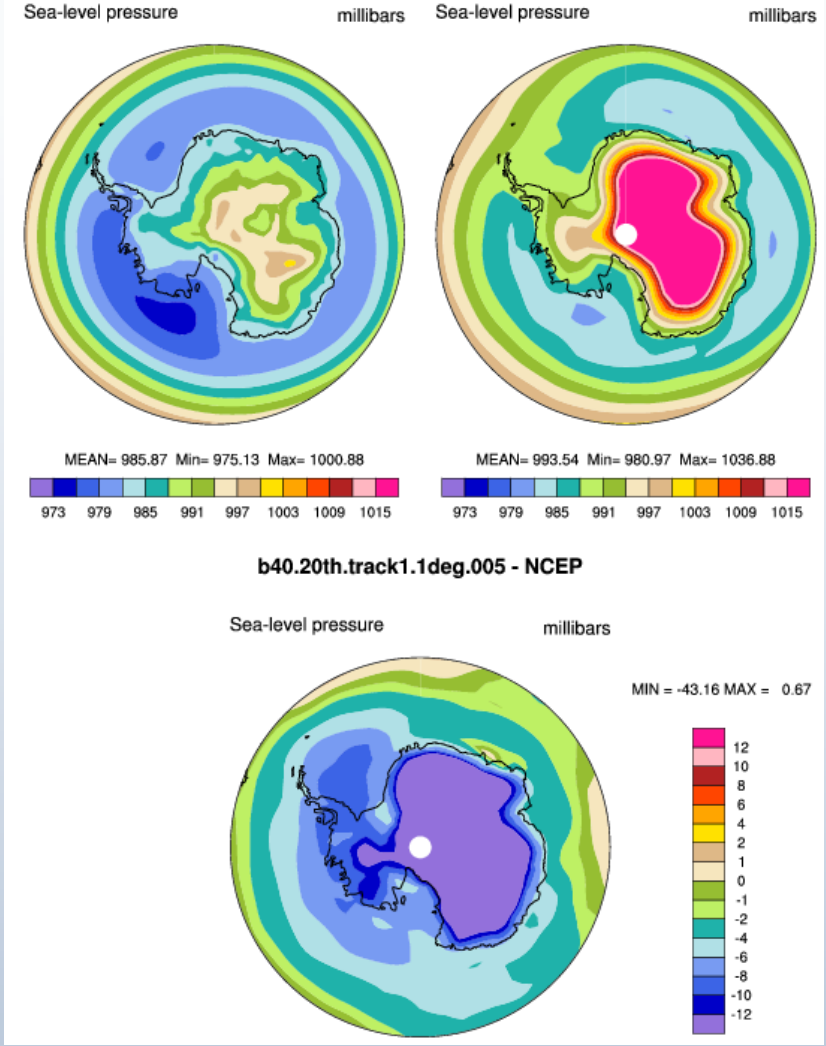
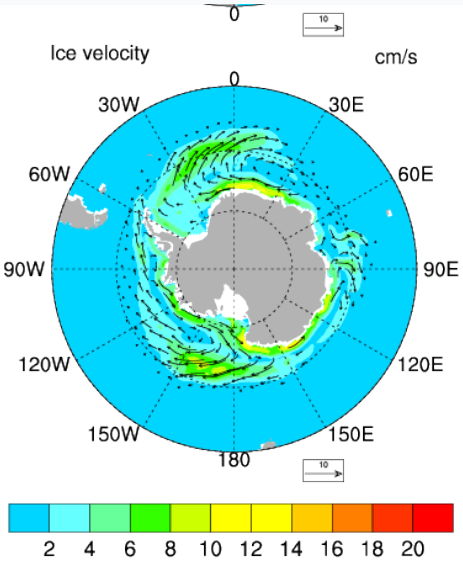


Antarctic Sea Ice Velocities (JFM)

CESM-CAM5.1 E2



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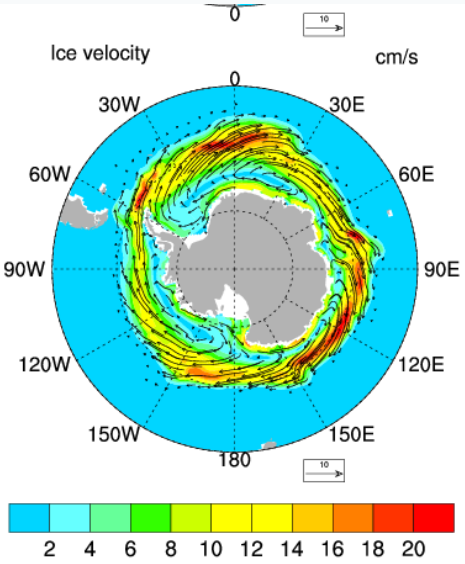
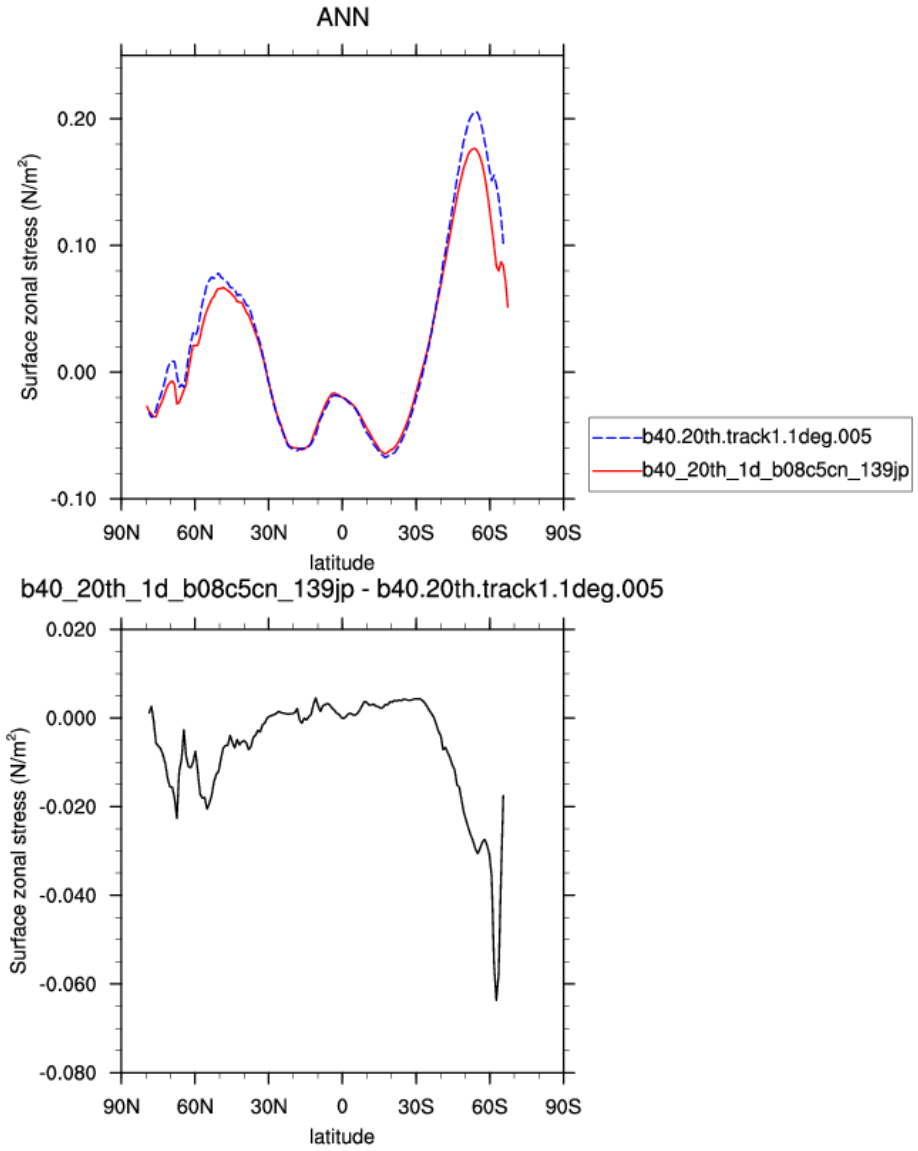


Zonally Averaged Wind Stress (ANN)

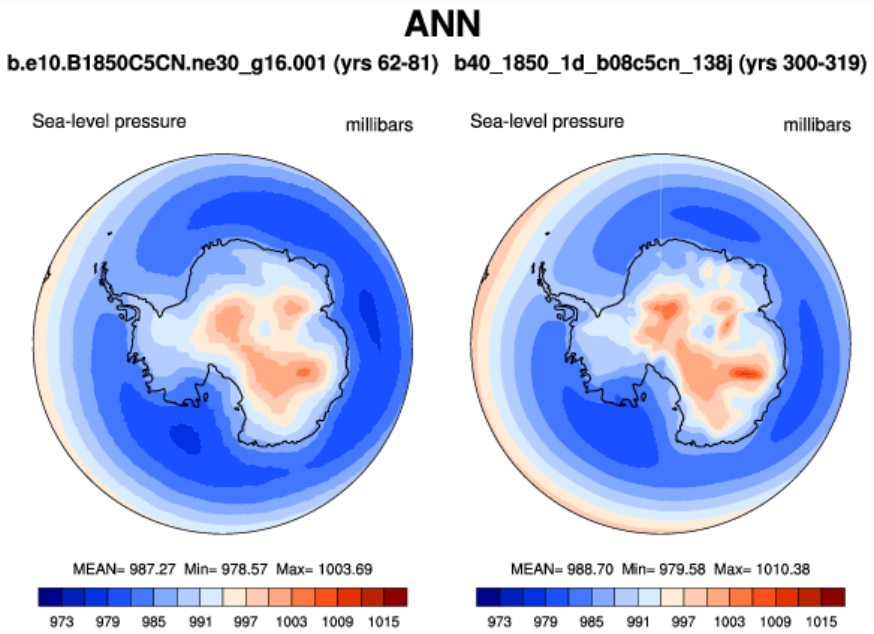


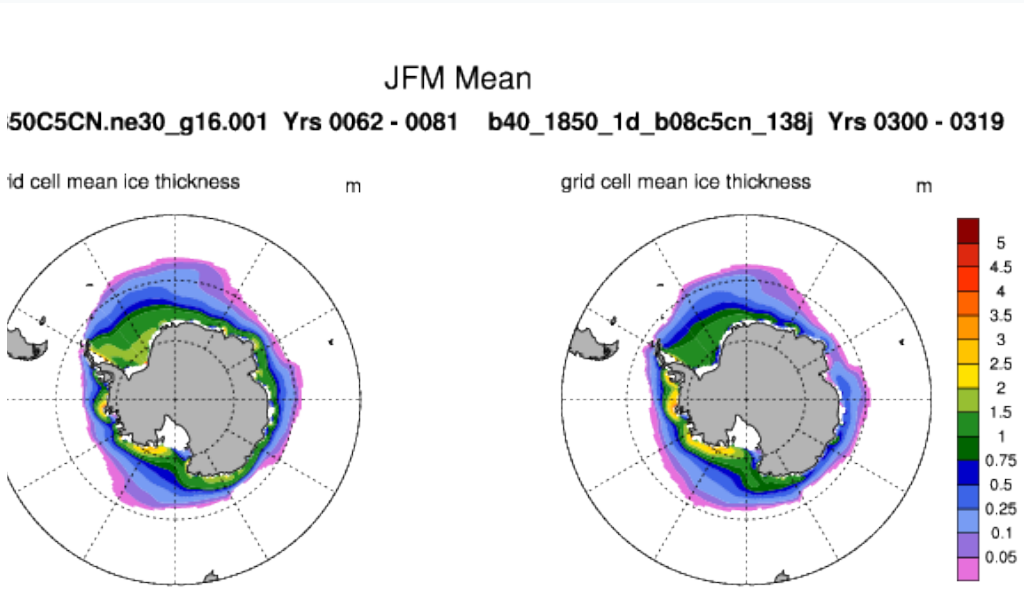
Summary

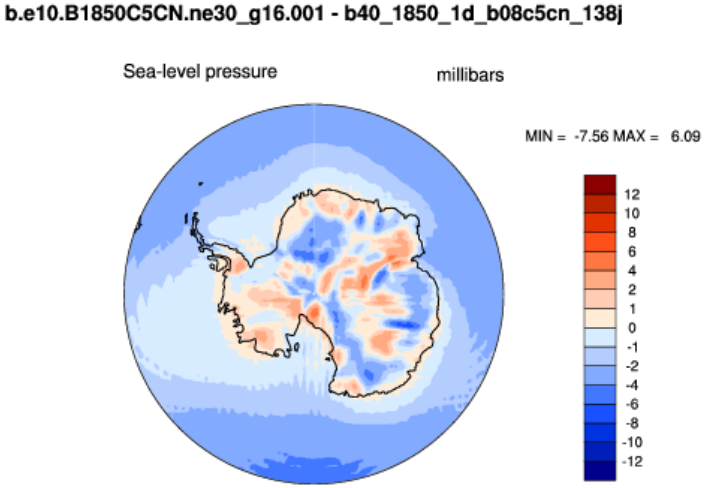
- Better atmospheric circulation and sea ice extent, but worse sea ice thickness pattern overall in CESM-CAM5.1 and WACCM4 runs.
- TMS moves surface momentum from tropics and mid-latitudes to poles -> Higher surface pressure and colder surface temperature near the pole.
- NH: Stronger surface circulation over the Arctic sea ice resulting in secondary thickness maximum north of Siberia.
- SH: Stronger circulation over the Antarctic continent, but weaker circulation over the sea ice resulting in anemic Weddell Sea circulation.
- Key points: Magnitude and location of wind stress maximum.
- Work in progress to better understand tuning of TMS parameterization, sensitivity to sub-gridscale topography, and interaction with resolution.

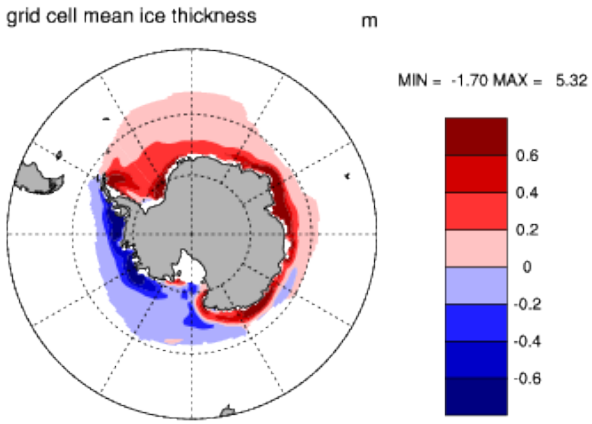
NCAR is sponsored by the National Science Foundation.
Funding from NSF OPP for D. Bailey is gratefully acknowledged.

Modified Topography









Higher Atmospheric Resolution